

ROCKET ENGINE NUMERICAL SIMULATOR

OVERVIEW PRESENTATION

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ROCKET ENGINE NUMERICAL SIMULATOR

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ROCKET ENGINE NUMERICAL SIMULATOR

RENS DEFINITION

- Rocket Engine Numerical Simulator (RENS)
Performs Liquid Rocket Engine Propulsion
System Analyses and Design
- RENS Gives Engineer a 3-D Transient Tool for
Analyzing Engine Systems (Tanks - Feed System
- Thrust Chamber)
- RENS Will Surpass/Encompass Capabilities of
Current System Codes (ROCETS & Generic
Power Balance)

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RENS DEFINITION

- RENS is Long Term and Large Scope
- RENS Features Include:
 - System Executive
 - Data Management
 - Graphical User Interface
 - Incorporation of Users' Technical Codes
 - Easy to Use
 - Industry/University/
Gov't Advisory Group
 - Public Domain
 - Evolution of
Capabilities

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OBJECTIVES

- Enable spontaneous and adaptive rocket definition, generation, performance evaluation, and failure analysis.
- Develop capability to simulate component and system level performance of rocket propulsion systems.
- Provide rapid and accurate assessment of rocket to increase design efficiency.
- Incorporate and integrate validated computational simulation codes/technologies.

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JUSTIFICATION

- Following capabilities required by NASA to do our job: independent verification of proposed rocket performance, new rocket designs, assess impact of new rocket technologies.
- Standardized industry design/analysis tool (industry-university-government participation).
- Streamline, enhance, and alter research & analysis process to reduce time and cost.

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APPROACH

- The RENS program will be patterned after, and will leverage from, the Numerical Propulsion System Simulator (NPSS), currently under development at NASA LeRC for aircraft propulsion systems.
- RENS will incorporate component level descriptions to predict performance and reliability.

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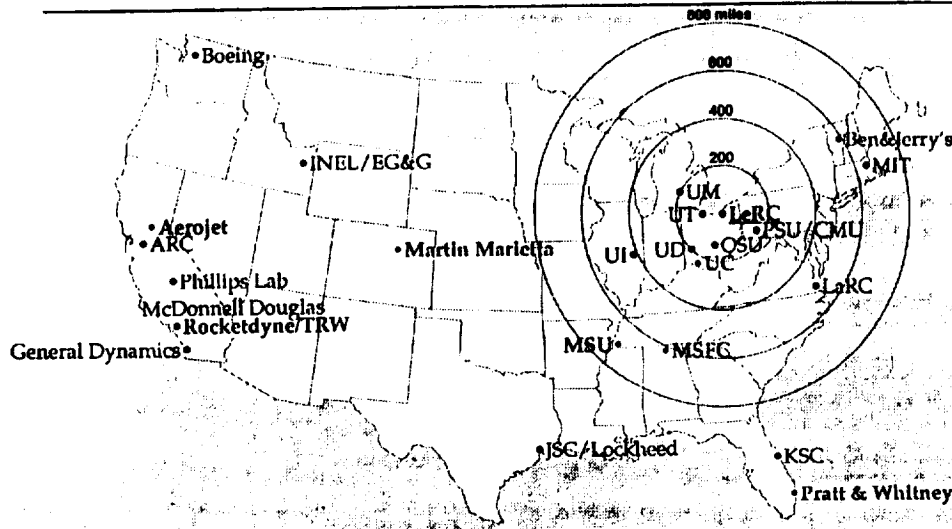
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POTENTIAL APPLICATIONS

- Chemical Propulsion Systems
- Nuclear Thermal Propulsion Systems
- Propulsion System Test Facilities
- Nuclear Electric Propulsion Systems
- Space Power Systems

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POTENTIAL USERS

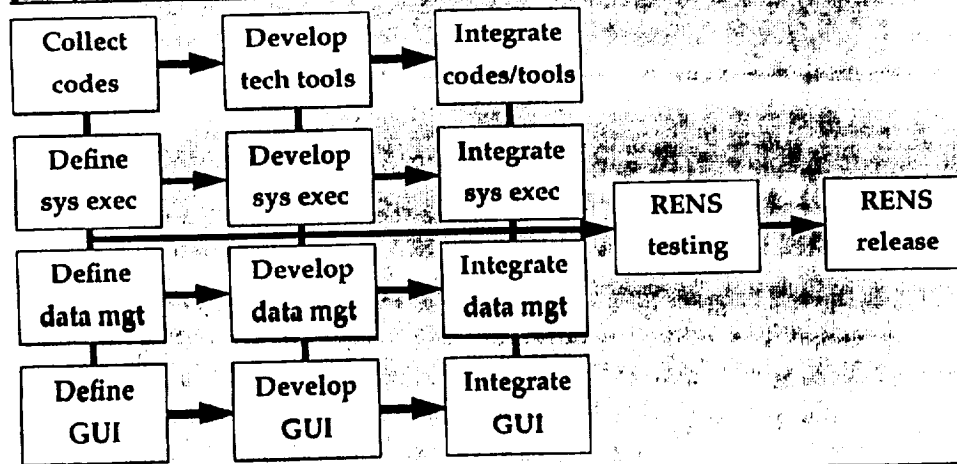


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RENS WORK STRUCTURE

RENS WORK BREAKDOWN FLOW CHART



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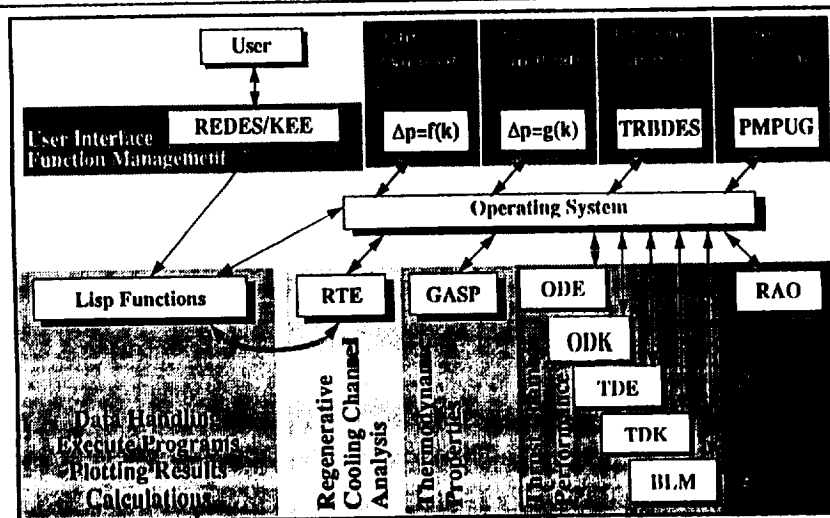
RENS PROTOTYPE - REDES

- Prototype Capability Initiated in 1989 with Rocket Engine Design Expert System (REDES).
- REDES Used to Conduct Various Studies and Model Various Engines:
 - Nozzle Performance Parametrics (SSME, RL10)
 - Nozzle Design (NTR)
 - Rocket Engine Test Facility Capability Assessment (NASA LeRC Rocket Engine Test Facility Ejectors)

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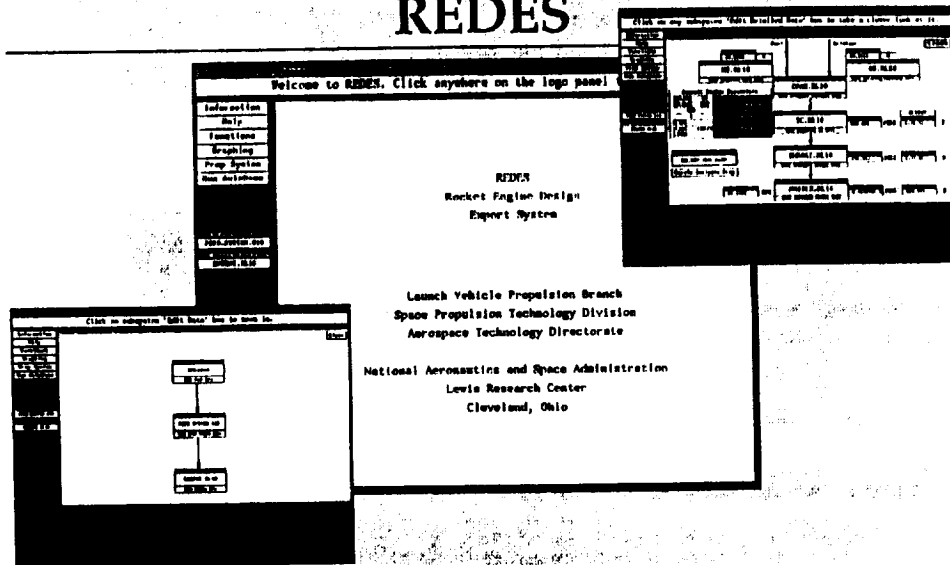
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REDES ANALYTICAL DOMAIN



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REDES



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CONCLUSIONS

- RENS Capabilities Required For Simulation Development.
- Simulation Capability Required By Gov't, Industry, and University in Many Technical Disciplines.
- RENS Prototype Exists at LeRC.

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RENS USER SURVEY (part 1 of 2)

Q: How Would You Use RENS?

**Q: What Would You Add To the Current RENS
Description? What Would You Delete?**

**Q: What Do You Like About the Current RENS
Description? What Do You Dislike?**

**Q: What Would Be the Impact of Using RENS On
Your Organization? Technology Benefit? Cost
Benefit?**

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RENS USER SURVEY (part 2 of 2)

**Q: Would You Be Interested In Developing Some
Portion of RENS? What Portion?**

**Q: How Would You Justify Expending Resources
In the Use of RENS to Your Management?**

**Q: May We Cite Your Responses In Our Advocacy
Presentations to NASA Headquarters?**